An Evaluation of Long-term Trends in Beaver Lake, Derry, NH

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Background

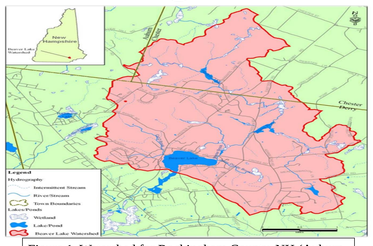


Figure 1. Watershed for Rockingham County, NH (Auburn, Chester, and Derry).

Beaver Lake is a 137-acre lake located in Derry, NH. The watershed has changed over the last 50 years due to population and business development [1]. New Hampshire Department of Environmental Services (NHDES) and the Volunteer Lake Assessment Program (VLAP) have partnered with the community over recent years, actively engaging in selecting management strategies that can be implemented to solve problems within their communities (Derry, Auburn, and Chester)[5].

Figure 2 shows an aerial photo of Beaver Lake taken in October 2007 and March 2024.

Watershed/ Land development

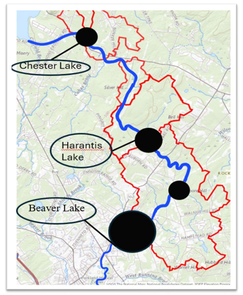


Figure 3. The waterway path from Masebisic Lake and flows down through Beaver Lake.

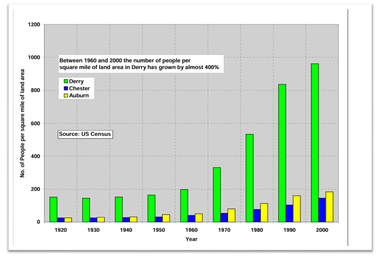


Figure 4. Population growth in Rockingham County, NH, from 1920 to 2000

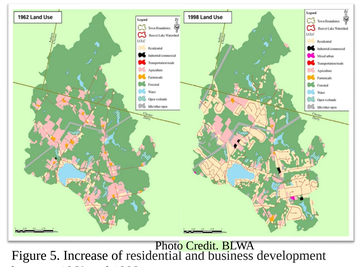


Photo Credit. BLWA

Figure 5. Increase of residential and business development between 1962 and 1998.

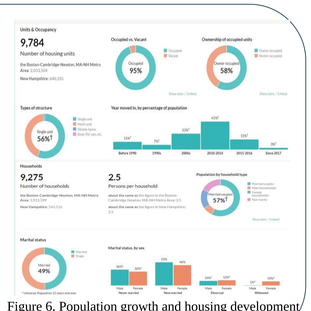


Figure 6. Population growth and housing development within Rockingham Watershed from 1962 to 1998.

Each year, NHDES solicits projects to address nonpoint source (NPS) pollution by implementing Watershed-based plans for priority watersheds. Watersheds can significantly influence the water quality within a specific geographical region where all water sources within its confines ultimately converge into a shared body of water (see Figure 3). NHDES assesses the appropriateness of a water body for its intended purposes by considering a range of factors, including its physical, chemical, and biological attributes and geographic context [1].

The total population of Rockingham County increased exponentially since 1960 and continues to grow steadily (Figure 4). Due to anthropomorphic activities, land use trends in Beaver Lake's watershed have significantly changed since 1960, altering water quality parameters (Chloride, pH, Chlorophyll, and more) [2]. The area surrounding Beaver Lake was reviewed by analyzing historical topographic maps to understand how land usage has changed in the watershed and how residential and commercial subdivisions, roads, and other uses have replaced wildlife habitats (Figure 5).

NHDES created a water management plan to outline strategies and actions for sustainable management and protection of a particular watershed or drainage basin. This involves collaboration among government agencies, community organizations, environmental groups, and residents to manage and protect the watershed effectively. The plan is essential due to the town's rapid growth (Figure 6.) and aims to reduce the risk of pollutants (fertilizer, sewage, Dissolved Organic Compounds) entering the water.

The Beaver Lake Watershed Management Plan (Plan) was driven by the community and facilitated by the Partnership and NHDES. The Partnership is subdivided through interactive meetings into specialized resource groups, each focusing on distinct aspects such as water quality, quantity, recreation, land use, and biological and habitat components. Utilizing feedback obtained during the initial Partnership session, participants engaged in collaborative discussions to identify primary concerns and develop corresponding mitigation strategies.

Road Practices

Road Salt

Human activities such as road salt, stormwater runoff, fertilizer use, impervious surfaces, septic systems, and landscape modification can harm our water bodies (figure 7) and the organisms that depend on them. It can contaminate drinking water, harm wildlife, increase soil erosion, and damage private and public property.

Figure 7. Snowplow on Pond Road

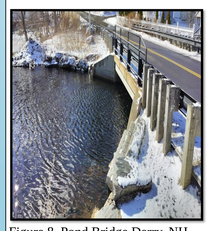
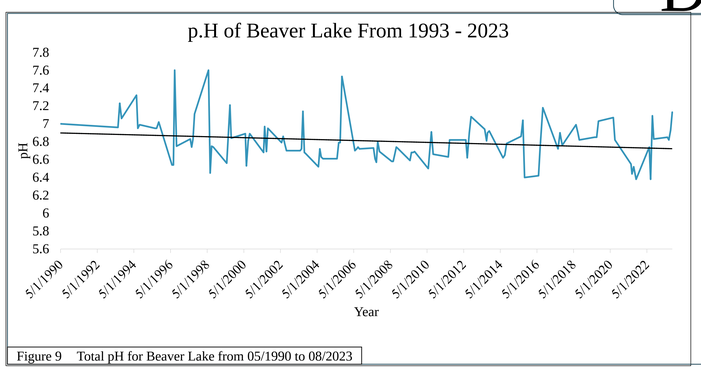


Figure 8. Pond Bridge Derry, NH

pH and Alkalinity

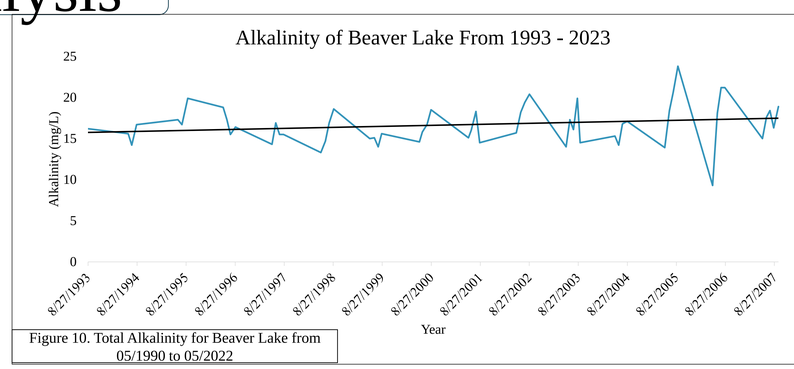
The pH level of a body of water is influenced by various factors such as the characteristics of the watershed, the land use history, and the patterns of atmospheric deposition. Aquatic life can thrive best in a pH range of 6.5 to 8.0, as it affects the availability and solubility of nutrients in water. However, some factors can contribute to changes in pH levels in water, such as acid precipitation, heavy metal toxins, and increased levels of Co_2. These factors can cause alterations in the pH levels which can negatively impact the aquatic life residing in the water body.

Data/Analysis



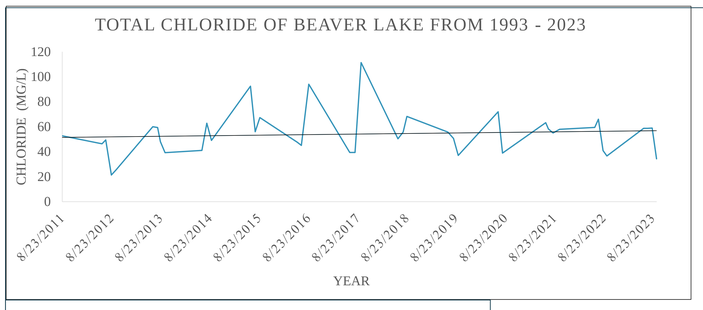
pH has increased from 6.9 to 6.7

Figure 9 Total pH for Beaver Lake from 05/1990 to 08/2023



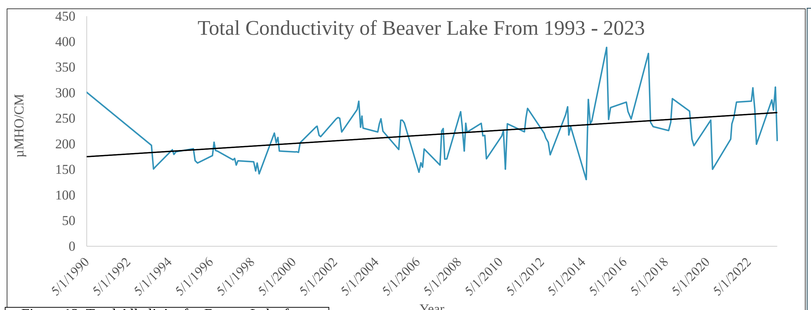
Alkalinity has increased from 16.6 to 18.2 (mg/L).

Figure 10. Total Alkalinity for Beaver Lake from 05/1990 to 05/2022



Chloride levels have increased in Beaver Lake from 52.7 to 58.8 (Mg/L)

Figure 11. Total Chloride Concentrations for Beaver Lake from 08/2011 to 08/2023



Conductivity has increased from 175 to 225 (µS/cm)

Figure 12. Total Alkalinity for Beaver Lake from 05/1990 to 05/2022

Conclusion

Based on the VLAP report's results, Beaver Lake is moving towards a healthier state. While the pH levels have decreased slightly from 6.9 to 6.7, they still fall within the acceptable range for aquatic life, typically between 6.5 and 8.0. Various factors, such as geological features, vegetation, land use history, and atmospheric deposition patterns, contribute to these pH fluctuations.

Additionally, although chloride levels in Beaver Lake have shown an upward trend, they remain within the recommended range of 230 mg/L, as outlined by NHDES [4]. This trend is depicted in Figure 11, indicating a consistent monitoring effort over the past two decades.

Furthermore, the data collected by NHDES and VLAP indicate that chloride and conductivity levels across the state have consistently stayed within the recommended limits over the same period. This suggests effective management practices and ongoing monitoring efforts to protect and preserve water quality in Beaver Lake and beyond. Continued vigilance and collaboration among stakeholders will be essential in maintaining and further improving the health of our water bodies.

References

[1] Wamser, M., & Sullivan, G. (n.d.). *Beaver Lake Watershed Management Plan*. Beaver Lake Watershed Management Plan 2007. https://www.beaver-lake.org/watershed-management
[2]Population Density (Per Sq. Mile) [Map]. *In SocialExplorer.com. ACS 2016 (5-Year Estimates)* https://www.socialexplorer.com/8e62e93dee/view
[3] Everett Turnpike (US 3, I-293, and I-93), BostonRoads.com.
[4] *Impacts of chloride on Biological Systems*. SEWRPC. (n.d.). https://www.sewrpc.org/SEWRPCFiles/Environment/RoadSaltStudy/TR-62-Chapter3PreliminaryDraft.PDF
[5] *Publications of the National Water and Climate Center*. Natural Resources Conservation Service. (n.d.). https://www.nrcs.usda.gov/resources/data-and-reports/publications-of-the-national-water-and-climate-center